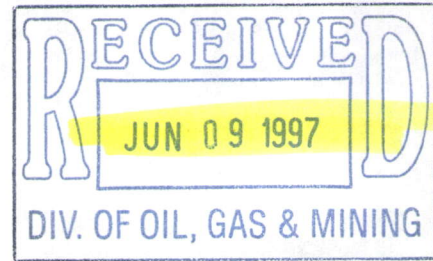


M/027/007

Received via e-mail (from Dave Rupp)

January 17, 1996

Evert Lawton, Ph.D., P.E.
Consulting Geotechnical Engineer
6811 Nye Drive
Salt Lake City, UT 84121



Subject: Jumbo Mining Company Heap & Pond Design

Dear Dr. Lawton:

We recently received draft plans for a new heap for leaching at the Jumbo Mine facility near Delta, Utah. We have reviewed the plans. The drawings make substantial progress in fulfilling the design requirements. We have the following comments:

1. Since PVC materials are more vulnerable to failure and solar decomposition than high density polyethylene (HDPE), HDPE is the preferred liner material. Exposed areas of liner must be ultraviolet radiation resistant. White, reflective liner is also recommended for exposed liner.
2. Please show the proposed height of the ore. Is the slope of the heap flat enough to keep the pile stable? We recommend the ore cushion extend beyond the ore, to near the edge of solution channels.
3. Typical ore gradation, including maximum size, needs to be provided.
4. The permeability of clay layer below the drainage material must be 1×10^{-7} cm/sec or less.
5. Enclosed is a sketch of a pond liner and sump design as discussed in our meeting on December 20, 1995. The upper liner should be 80-mil. The bottom liners should be 40-mil minimum. If the current liner is to be salvaged, please include the salvage method with the plans.
6. Our comments on the drawings are listed below:

Sheet 2:

- a. Drain detection material beneath the clay may be stopped, outwardly from the edge of the ore pile.
- b. On Detail 3, the drain detection material in the fillet is not required. It should be clay.

Sheet 7:

- c. Per Detail 6, we have a more economical design for peripheral leakage detection. A sketch of the method is enclosed. If leakage occurs, the low point in a panel would swell. This indicates a leak, somewhere in that panel, needs repair.
- d. Peripheral liner leak monitor ports should be more frequent, piping at 50 feet on center maximum. However, the closer they are together, the easier to find a leak. Two separate panels are recommended in the southeast corner.
- e. Heap leak detection lines and sumps should be more frequent, at 100 feet on center maximum.
- f. On Detail 7, no drainage detection material is needed, outwardly from the edge of the

ore. However, continuation of the leak detection pipeline, without any perforations, is necessary. Perforation is not necessary for the monitoring pipe.

g. Details 6, 7, and Section E-E, therefore need adjustment.

Sheet 8:

- h. Calculate normal leach flow depths along with 25-year, 24-hour storm depth in channels, and the adequacy of the 18-inch diameter outlet and slopes. Does the southern dike need to be higher due to the approaching fluid velocity head?
- i. Detail 9 appears to have some inaccuracies, when compared to other channel dimension drawings.

Sheet 11:

- j. Settlement stands would not be required at this site, if the grading plan were changed slightly. This is true, if the prepared foundation is all cut to grade.
- k. Add a head monitoring system, over the flexible membrane liner, for the heap. One foot maximum head is the limit. Therefore, a 1.5-foot minimum height riser pipe may be adequate. Use risers, similar those shown for the settlement stand drawing on Sheet 11.

Mr. Mark Novak will be writing you separately regarding existing environmental and ground water permitting issues. Please respond to the above in writing, incorporating appropriate items into the plans and specifications. If you have any questions, please contact me.

Sincerely,

David A. Rupp, P.E.
Design Evaluation Section

Enclosures (2)

- 1. Pond liner
- 2. Peripheral monitoring port and sump

cc: Mr. Roger Foisy, P.E., District Engineer (w/o encl)
Mr. Ed King, Jumbo Mining Company (w/o encl)

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